CORRELATOR HELPS PUT A FINGER ON CRIME, PRODUCTION PROBLEMS

A superfast optical correlator system may help machines "see" faster, allowing real-time inspection of human fingerprints and assembly line products.

Once, our eyes were all the quality control we needed. These days, as production lines have speeded up, electronic eyes do most of the inspecting. But even today's digital machines are struggling to process imagery fast enough, increasing the possibility of costly mistakes. This will soon change, though.

CoreTek, Inc. (Burlington, MA), has developed a fast optical correlator system that can swiftly crunch images, helping to drive the conversion of all-optical-processing systems into powerful processing products for pattern-matching applications. The system, which can process more than 4,000 images per second, promises dramatic speedups for such jobs as matching fingerprints and detecting damaged products on assembly lines. For example, finding a match of a fingerprint electronically among millions typically takes several days. Soon, it may take only seconds.

■ QuantaImage researchers have reduced the size of its fingerprint recognition system so that the "guts" of the technology now fit completely inside two disk drive bays on the PC (pictured above).

The key to the system's throughput is the use of spatial light modulators (SLMs). Unlike digital imaging systems, which require a high-speed electronic camera, SLMs capture images directly from the environment, reducing the time typically lost to digitization and mathematical operations. The SLMs are made of a newly created quantum-well-based material that increases the speed and sensitivity to a level greater than what is available in most similar devices. For example, they are 1,000 times faster and 10 to 20 times more sensitive than commercially available liquid crystal SLMs. BMDO's SBIR program funded CoreTek to develop the optical image processing technology to speed up the process of locating and tracking a missile.

Licensing deals. Several licensing agreements and prototype demonstrations indicate that CoreTek is serious about commercializing its technologies. CoreTek established licensing deals with a photonics company in Huntsville, Alabama, for its correlator technology, and with an opto-electronic company in the Northeast for its modulator technology. These deals secured much-needed funding to continue product development and commercialization activities. CoreTek also demonstrated its optical correlator prototype at a manufacturing plant of a major fruit juice company. Placed near the conveyor belt, the optical processor was able to quickly identify defective fruit, enabling the manufacturer to improve quality control on the spot.

Focusing on law enforcement, CoreTek has incorporated its optical correlator technology into a high-speed optical fingerprint identification (OFID) system. The original prototype processed more than 1,000 images per second, but recent improvements have almost quadrupled its throughput. At this rate, the system can identify a print from a 500,000-fingerprint database in less than 10 seconds. Existing electronic technology claims to be able to match images at rates of 3,000 images per second, but only after the number of potential matches has been limited by preprocessing information.

The OFID technology developed at CoreTek has been licensed to QuantaImage, Inc. (Burlington, MA), a newly formed spinoff company. Currently, QuantaImage is making hardware and software modifications to the existing prototype in preparation for marketing to potential customers. The hardware will consist of an ultracompact 1 x 2 x 4-in. optical correlator unit interfaced with an electronic database (a personal computer). The software is being modified to prefilter the database based on the demographics and to ensure the quality of fingerprints so the error-free laboratory performance can be sustained in real operating conditions.

Fingering criminals. QuantaImage's superfast fingerprint identification system is targeted for use in environments where positive identification needs to be established quickly and reliably. "Our optical processor can process four images every millisecond, compared with every 4 seconds for other commercially available systems," says Ergun Canoglu, vice president of QuantaImage. "This speed advantage makes it attractive for a variety of pattern-matching applications, from controlling products on high-speed conveyor belts to identifying criminal fingerprints on large electronic databases."

According to QuantaImage, two emerging markets for fingerprint identification are corporate security and World Wide Web (WWW) access. MasterCard annually loses $450 million, or 9 cents of every $100 in charges, to credit card fraud. Using digital fingerprint scanning technology in a recent test, MasterCard cut fraudulent charges by 80 percent. Fingerprints also could be used to allow WWW browsers access to a company's network and files.

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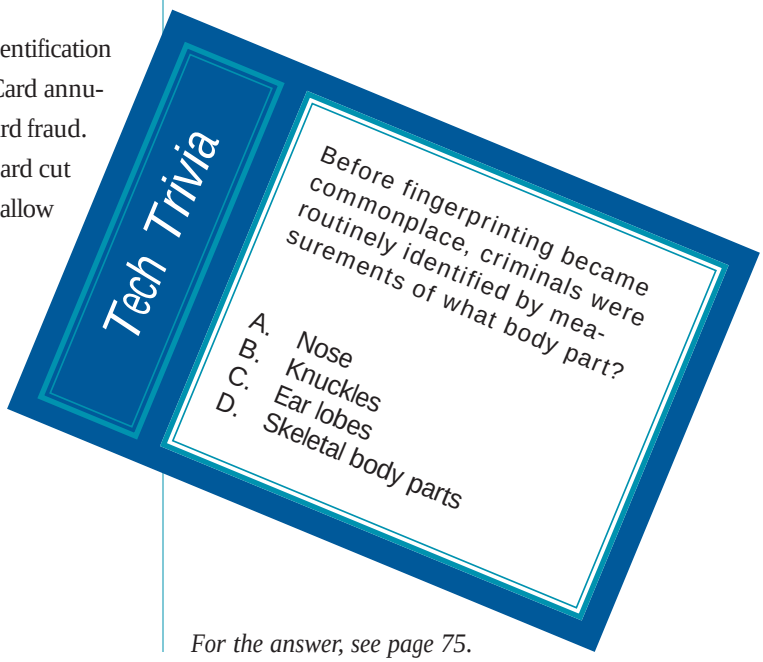
What Does It Mean to You?

Building optical image processors into scanning systems can help law enforcement officials solve crimes and catch criminals, making neighborhoods safer.

What Does It Mean to Our Nation?

Scanning systems based on optical image processing could help the Federal Bureau of Investigation reduce the backlog of fingerprint analysis cases.



For the answer, see page 75.